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AQUILA REMOTELY PILOTED VEHICLE

Recent Developments and Alternatives

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UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

NATIONAL SECURITY AND
INTERNATIONAL AFFAIRS DIVISION

January 4, 1986

B-205804

The Honorable William V. Roth, Jr.
Chairman, Committee on Governmental Affairs
United States Senate

Dear Mr. Chairman:

As you requested, we reviewed the Aquila Remotely Piloted Vehicle Program and the Army's consideration of alternatives to the Aquila. We focused on the program's technical problems revealed in the last 6 months as well as their effect on Aquila's cost, schedule, and management.

We found that the Aquila program recently underwent a major restructuring in response to the technical problems revealed in testing. Among the program changes were shifting program management from the Army's Aviation Systems Command to its Missile Command and deferring the production decision until the remaining technical problems could be resolved. We also found that the Army's 1984 study of alternatives to Aquila did not consider several factors which could have made for a more balanced comparison. These findings, along with recommendations to the Secretary of the Army, are discussed in detail in appendix I.

In conducting our review, we met with the Under Secretary of the Army and interviewed cognizant officials of the project offices at the U.S. Army Aviation Systems Command and at the Missile Command, members of the special task force convened by the Army to assess the Aquila's difficulties, and other Army officials. We examined pertinent documentation on the Aquila program and alternatives, including the report of the special task force.

We did not obtain official agency comments on this report. However, we discussed the report with the Under Secretary of the Army and with representatives from the Office of the Secretary of Defense. According to the Under Secretary of the Army, the Aquila is the best choice for meeting the Army's more immediate needs provided the contractor can demonstrate in tests now in

progress that solutions to Aquila's remaining problems are in hand. He added that the Army is studying alternative systems that may be better choices than the Aquila for future missions.

The Army advised us that the prime contractor for the Aquila has until the end of January 1986 to demonstrate that it has resolved the technical problems. If the program is canceled, any reevaluation of alternatives should not repeat the omissions of the Army's 1984 study. If the Army determines that the problems are resolved and continues with the program, we intend to review the indicated solutions and will report on the results of our review.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of the report. At that time we will send copies to interested parties and make copies available to others upon request.

We trust this information will be helpful to you. If we can be of further assistance, please call Zeke Baras at 275-4136.

Sincerely,

Frank C Conahan

Frank C. Conahan
Director

MAJOR DEVELOPMENTS IN THE ARMY'S REMOTELY PILOTED VEHICLE PROGRAM

The Army's Aquila Remotely Piloted Vehicle (RPV) has had numerous difficulties since it entered full-scale development in 1979. Among these have been technical performance problems and funding cuts, which have led to substantial cost growth and schedule slippage. During the past year, the emergence of critical performance problems during testing led to a major program restructuring and threatened the Aquila's future. Prior to these changes, costs to acquire the Aquila were estimated at about $2 billion. This estimate has not yet been revised to reflect the recent changes.

Several RPV systems exist in addition to the Aquila. The Army considered these alternative systems in a study it made in 1984 from the standpoint of their possible availability and potential to perform in the stringent environment envisioned for Aquila's use. We found that although the study did not consider several factors which could have led to a more balanced comparison, the Army chose to continue the Aquila development because of its earlier availability. The Army had been considering a number of future missions for inclusion on the Aquila system; however, alternative RPV systems have since gained significantly in the Army's consideration for future missions.

The Army has charged the contractor with finding solutions to major technical problems before it will go forward with the program. If the contractor is unable to resolve those problems and the program is terminated, we believe any ensuing study of alternatives should not repeat the omissions of the 1984 study.

MAJOR TECHNICAL PROBLEMS CONTINUE

Contractor and Army tests of the Aquila in 1984 and 1985 demonstrated significant technical problems in flight performance and mission capability. In May 1985, a special task force, referred to as the Red Team, was convened to evaluate the Aquila's readiness for operational testing which was to run from September through December 1985. The team's findings, which included serious performance limitations and shortages in air vehicles, led to major changes in the program's schedule and the Army's management of the program.

Flight Test History

--Although 10 of 66 flights resulted in crashes or unplanned parachute recoveries during 1984 (air vehicles will not have parachutes in combat), the contractor began preliminary qualification testing in January 1985.

--In May 1985, the Army project manager began development tests but reported that, although most performance requirements had been demonstrated, five critical system capabilities had not been successfully demonstrated in the contractor's preliminary qualification tests.

--The critical capabilities not demonstrated were

-acquiring, tracking, and designating moving targets;

-automatic recovery of the air vehicle;

-a backup recovery system;

-the ability to fly for extended periods without receiving updated information from the ground station; and

-the ability to navigate with periodic updates from ground systems.

--Although these capabilities were not demonstrated, flights from January through May 1985 showed substantial flight performance improvement, as only 3 of 97 flights ended in crashes or unplanned parachute recoveries.

--After May 1985, however, flight performance worsened, as 8 of 92 flights ended in crashes or unplanned parachute recoveries from June through early December 1985.

Red Team Evaluation

--The Red Team, in July and August 1985, reported many other issues in addition to the critical deficiencies reported by the project manager whose resolution would be critical to a successful demonstration of the Aquila's performance. These included durability problems; poor reliability of the

data link, mission payload, and air vehicle; and lack of hardware and software representative of the final configuration.

--The team also questioned the value of the contractor's tests, noting that key performance issues had not been well specified by the government, that test data did not support the success claimed, and that design changes had rendered the test data obsolete.

--Coupling these critical issues with an existing shortage of assets resulting from continuing crashes, the Red Team estimated that the Army would run out of air vehicles before the operational test could be completed.

AQUILA PROGRAM RECENTLY RESTRUCTURED

As a result of the Red Team findings and an increase in the number of air vehicle crashes after May 1985, senior Army management has taken dramatic action to resolve technical problems and has instituted several program management changes.

Operational Tests and Production Decision Deferred to Correct Problems

--Operational testing of the Aquila, slated for September 1985, has been deferred until September 1986.

--The production decision for the Aquila has been rescheduled from March 1986 to March 1987.

--Both events will be subject to successful demonstration of Aquila's capabilities. Deferral of operational testing and the production decision has increased the development schedule from 79 months to 91 months.

--In September 1985, the Army suspended its development tests because of Aquila's continuing technical performance difficulties. Testing is tentatively scheduled to resume in February 1986 if the contractor demonstrates technical problems have been corrected.

--The Army has given the contractor until the end of January 1986 to demonstrate, at its own expense, that major technical performance difficulties have been fixed. If successful, the Army will begin sharing the cost to complete full-scale development on a 50/50 basis with the contractor.

--The Army has obtained a commitment from the contractor to contribute up to $50 million of its own money to correcting the problems and completing development.

Significant Changes Made in Program Management

--In August 1985, responsibility for the program's management was transferred from the Army Aviation Systems Command in St. Louis, Missouri to the Army Missile Command in Huntsville, Alabama.

--A new project manager was assigned, the seventh in 8 years, and only 2 of 37 civilian personnel slots transferred to the Missile Command are being filled with personnel from the Aviation Command. According to senior Army management, the move would take advantage of the Missile Command's greater expertise in the development areas that remain to be completed.

Fiscal Year 1986 Funding Status

--There is currently $66 million in the fiscal year 1986 appropriations for RPV procurement.

--Since the production decision has been deferred until fiscal year 1987, procurement funds will no longer be needed to procure Aquila systems in fiscal year 1986.

--The Army plans to retain about half of the $66 million as procurement funds to be used for pre-production preparations and evaluating alternative RPV systems for future missions.

--The Under Secretary of the Army advised us that fiscal year 1986 development funds would suffice up to about July 1986 and that a reprogramming action transferring the remaining procurement funds to development funds would be necessary

to continue Aquila's development for the balance of that fiscal year.

ADVANTAGES OF ALTERNATIVE RPV SYSTEMS HAVE NOT BEEN FULLY WEIGHED

The Army's 1984 study of alternative RPV systems was limited to the basic target acquisition, designation, reconnaissance, and surveillance mission and to comparisons of development costs and schedules. Three factors excluded from the study -- life cycle costs, a revised RPV employment concept, and future mission payloads -- would have shown alternatives to better advantage. Whether these advantages would outweigh the alternatives' comparative disadvantages to the point where alternatives might have represented a better choice than the Aquila would require further evaluation.

Life Cycle Costs May Have Made Comparison More Even

--In late 1984 the Army completed a study of alternative RPVs to the Aquila. After screening over 30 candidates, the Army selected 7 to compare with the Aquila.

--The Army developed a cost and schedule estimate of what it would take to modify and equip the one alternative which had the best data and used this as a general representation of what it would take to develop any of the seven alternatives to perform the basic mission.

--The study concluded that alternatives could be modified to meet basic mission needs, but projected that an alternative would cost $105 million more to develop and take 2 years longer to field than the Aquila. However, using data developed by the Army for the study, we found that when put on the same technical basis, an alternative would cost $99 million more than Aquila and take one more year to field, rather than two.[1]

[1]The Army study compared the cost to complete development of the Aquila, equipped for daytime use only and on a low risk schedule, with the cost to develop an alternative with both day and night capabilities on a higher risk schedule. Using Army data, we adjusted the costs and schedules to reflect a low risk schedule and day and night capabilities for both systems.

--The study did not consider differences in production costs and in operation and support costs. Army data at the time indicated that the alternative systems offered lower production costs than the Aquila. We found nothing to clearly indicate whether the Aquila or the alternatives have an advantage in operation and support costs.

Changes in Employment Concept Appear to Enhance Alternative Systems' Ability to Satisfy Basic Mission Needs

--The Army's original concept was to station RPV sections entirely within forward area divisional artillery batteries. The relative high mobility of forward units dictated several of Aquila's requirements, including a light vehicle so that it could be carried by four soldiers, and a precision recovery system, such as a net, rather than landing the vehicle on an airstrip. Since the forward artillery units must move frequently, the air vehicle must be recovered in sufficient time to allow for its ground systems to redeploy to another area. This frequent movement limited the maximum time that the vehicle could be in the air to 3 hours. The Aquila's 3-hour flight endurance specification was based on this limitation.

--In 1983 the Army revised the RPV employment concept to respond to evolving missions which the RPV could perform. The new concept called for launch and recovery by sections stationed in rear areas which would pass flight control to forward area sections. According to the Army, rear area basing required significantly less mobility than deployment in the forward area. However, the Army did not modify RPV requirements such as those for recovery and weight limitations in light of the new employment concept.

--The new concept also brought into question whether the Aquila's 3-hour endurance left sufficient time to complete the mission since it would take longer to fly the RPV to its target area from the rear than from the forward area. The Red Team estimated that launching and recovering the Aquila in the rear area would allow only 1 hour in the target area.

--Alternatives can fly up to 9 hours between takeoff and landing and could provide more time in the target area.

--If the Army had changed performance requirements to reflect the 1983 revisions to its employment concept, the endurance advantage of alternative systems could have played a more prominent role in the 1984 alternative study. Similarly, relaxation of recovery and weight limitations could have enhanced their competitiveness in that study.

Army Recognizes Advantages of Alternatives for Future Missions

--Alternative systems can carry payloads weighing up to 150 pounds, while the Aquila can carry up to 60 pounds. Alternatives can also tolerate greater shifts in their center of gravity caused by payloads before losing flight stability, compared with the Aquila.

--Senior Army officials recognized the limited potential of the Aquila to satisfy future missions because of the size and weight constraints of its payload capacity. In December 1984, they deleted the future mission payload development from the Aquila program and noted there may be a need for a "family" of unmanned air vehicles, possibly including the alternatives, to satisfy these missions.

--In 1985, the Army created a program management office, distinct from the Aquila program, to concern itself with the family of unmanned air vehicles required for evolving future missions and joint service considerations. The first future RPV mission, electronic intelligence, was approved in October 1985.

--Although the Aquila has not been excluded as a candidate for accomplishment of future missions, the larger payload capacities of alternative RPV systems have substantially enhanced their potential to carry out such missions.

--The alternatives' greater capacities offer potential cost savings and lower technical risks for future mission payloads because there should be less need to miniaturize components. Aquila's weight limit was a key factor in developing the basic mission payload and contributed to Aquila's lengthy and difficult development.

--The 1984 study did not compare development costs for future RPV mission payloads, such as for communications retransmission and electronic intelligence, which were part of the Aquila program at the time, though relatively undefined.

Alternatives' Disadvantages Must Also Be Weighed

--Some alternatives use runway landing techniques which have more potential for losses and damage through crashes.

--Alternative air vehicles are larger than the Aquila and could be sighted more easily by enemy observers.

--Alternatives may be more difficult to pilot than the Aquila and may require more personnel to operate.

--Alternatives would still have to undergo some development before fielding, perhaps even more than the Aquila. They would likely take longer to field.

COST AND SCHEDULE--GROWTH AND DELAY

The Aquila program has already experienced considerable cost growth and schedule delays stemming from technical problems, funding limitations and expanded capabilities. The table below shows the Aquila's costs, development schedules, and quantities as they were estimated at given times during full-scale development. Recent program actions, discussed earlier, will further increase costs, but estimates are still under revision.

Aquila Cost, Schedule, and Quantity History

	1978	1982	1983	1984	1985
Acquisition costs (millions):					
Development, basic system	$123	$477	$482	$590	-
Development, night capability	-	113	105	96	-
Procurement	440	1,425	1,348	1,386	-
Total	$563	$2,015	$1,935	$2,072	-
Procurement quantities:					
Air vehicles	780	995	548	543	376
Ground stations	72	74	80	77	53
Development schedule (months)	43	70	70	79	91

--Development cost increases and schedule delays for the basic system have been caused by technical problems continuing throughout full-scale development and by cuts sustained in September 1981.

--In 1982, development costs were increased further by adding a night mission capability. Procurement costs also increased as the added capability required additional payloads and air vehicles. Escalation associated with program stretchout aggravated these increases.

--Since 1982, total estimated procurement costs remained fairly constant despite increasing unit costs because air vehicle quantities declined.

--The change to the rear area employment concept in 1983 allowed for major reductions in the number of air vehicles and mission payloads required.

--In March 1985, the Army, mindful of affordability, began reducing the number of divisions to be supported. Official baseline cost estimates had not been prepared for this structure as of November 1985. The 1985 procurement quantities reflecting this reduction, as shown in the above table, are from planning documents.

--In September 1985, Army testing was suspended pending high level Army reviews to determine whether to proceed.

--By the time the program was restructured in late 1985, estimated costs for the prime contract had risen to $365 million, compared to an estimate of $101 million when the contract was awarded. The contract for full-scale development was awarded to the Lockheed Corporation in August 1979, the only bidder resulting from a competitive solicitation. Contract costs will likely increase again as a result of the recent testing difficulties which necessitated schedule delays and more testing.

VIEWS OF AGENCY OFFICIALS

We did not obtain official agency comments on this report. We did discuss a draft of the report with the Under Secretary of the Army and cognizant representatives from the Office of the Secretary of Defense. Comments from the Defense representatives have been incorporated in the report where appropriate.

The Under Secretary of the Army stated that the Army has studied alternative RPV systems for the basic target acquisition and laser designation mission, and has concluded that the Aquila offers the best system for meeting the stringent operational requirements of that mission within the shortest time frame. He noted in addition that (1) the Aquila's cost estimates were firmer than those for alternative systems, and (2) some alternatives require more personnel and require trained pilots to operate, which would add significantly to their life cycle costs.

The Under Secretary said that despite the continuing technical problems identified by the Red Team in 1985, it was more prudent to complete the Aquila's development by investing an additional estimated $50 million, rather than to invest significantly greater funds to bring an alternative system up to Aquila's capability for the basic mission requirements, and still not have the advantage of the earlier fielding that Aquila offers.

He views the contractor's demonstration of solutions to the Aquila's technical performance problems as a last chance for the program to succeed. The Under Secretary added that the Army has a comprehensive study under way to evaluate RPV systems that can perform future missions in a less stringent environment.

CONCLUSIONS

The Army's decision to continue Aquila's development was based primarily on its ability to perform the basic target acquisition and designation mission in a stringent environment, and on its availability for fielding earlier than alternative systems. Although the Army's 1984 study of the Aquila and the alternative systems concluded that the alternatives could be made to perform the mission in a demanding environment, they could not match Aquila's earlier availability.

Since that decision, the Army has identified serious technical problems in the Aquila's performance. The Army is prepared to abandon the Aquila for the basic mission should the contractor be unable to demonstrate in testing now under way that it has corrected the problems. In that case the Army will have to reevaluate the alternative systems for their ability to perform the mission.

The Army advised us that the contractor has until the end of January 1986 to demonstrate that it has resolved the problems. If the Army determines that the problems are resolved and continues with the program, we intend to review indicated solutions and will report on the results of our review.

If the program is canceled, any reevaluation of alternative systems should not repeat the flaws we have noted in the 1984 study, i.e., the omission of life cycle cost comparisons and the failure to consider the potential impact on performance requirements of the change in the Army's concept for launching RPVs from rear areas rather than from forward areas.

Regardless of which system will eventually serve to perform the basic mission, the Army plans to evaluate candidates for performing the future missions now evolving. Such an evaluation should similarly avoid repeating the omissions of the 1984 study, and should give credence to advantages of the various candidate systems such as greater payload capacity and endurance.

RECOMMENDATIONS TO THE SECRETARY OF THE ARMY

We recommend that the Secretary

--assure, in the event that the Aquila program is terminated, that an ensuing study of alternatives to satisfy the RPV's basic mission take into account not only the total life cycle costs of candidate systems but also any changes in performance requirements deriving from the revised employment concept, and

--assure that evaluation of candidate systems for future missions which are now being explored include total life-cycle costs and advantages of candidate systems such as greater payload capacity and endurance.

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